

GROUP COMPOSITION, PERCENTAGE SURVIVORSHIP, BIRTH RATE AND POPULATION OF *PRESBYTIS ENTELLUS* IN JAIPUR, RAJASTHAN¹

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Key words: langur population, Jaipur

Group composition, birth rate, percentage of survival and population growth of *Presbytis entellus* were recorded in temple, tourist, residential and forest/village habitats in and around Jaipur city. It appeared from data that there was a gradual decline in AF:I, AF:J and AF:SA ratio indicating a poor recruitment of breeding individuals. The population of langurs thrived comparatively well in temples.

INTRODUCTION

Macaques and langurs are found almost all over India but knowledge about their countrywide population is scanty and scattered, the status of rhesus population is better known than that of the most primates (Dolhinow and Lindburg 1983). Till 1978 the primate populations specially *Macaca mulatta* and *Presbytis entellus* were under pressure of export but presently they are under various pressures namely deforestation, industrialization, increased agricultural development of their habitat, human habitat, human population growth and commercial trapping (Bishop *et al.* 1981) and the changing attitude of people. In some areas in India the population of rhesus is reported to be declining (Southwick *et al.* 1980) but not much is known about the population trends of langurs. However, a decline in langur population was reported from Dharwar (Sugiyama and Parthasarathy 1969), only at some places their population has remained stable (Mohnot *et al.* 1981) and an increase has only been reported from temple areas (Southwick *et al.* 1983, Southwick and Siddiqui 1983). The urgency to estimate primate abundance in various parts of their range is being emphasised repeatedly in almost all the conferences on primates. The present paper is outcome of such a study done in Jaipur between 1985 and 1987.

STUDY AREA

Jaipur (26°55'N, 75°55'E) is the capital of the state of Rajasthan in India with an area of about

120 sq km. The region is semi-arid and the average annual rainfall is about 600 mm. Maximum temperature goes as high as 44°C during June and minimum could be 4°C in January. Common plant species are *Azadirachta indica*, *Delonix regia*, *Anogeissus pendula*, *Mangifera indica*, *Bauhinia* sp., *Cassia* sp., *Holoptelia* sp., *Bougainvillea* sp., *Polyalthia longifolia*, *Tamarindus indica* and species of *Ficus* and *Acacia*.

METHODOLOGY

During reconnaissance observations, all the groups of *Presbytis entellus* in and around the Jaipur city were located and identified (Mathur and Manohar 1987, 1990). For the present study selected groups were followed for 10-15 consecutive days. The habitat in and around the Jaipur city was differentiated into four types: (i) Temple, (ii) Residential, (iii) Tourist and (iv) Forest/Village. Selected groups in each habitat were observed to estimate population growth, and the birth rates, individuals of study groups were identified according to approximate age, (adults, subadults, juveniles and infant-I and infant-II), sex for group composition and survivorship. The survivorship is the percentage of individuals living at various ages in a population (Emmel 1973), it was calculated by dividing the total number of particular age-sex by total number of animals, multiplied by 100.

Four unimale bisexual groups in four different habitats were censused regularly for twelve months for birth rate which was calculated using the following formula:

$$b = It/Ft$$

$$b = \text{Birth rate}$$

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Ft = Total number of adult females observed throughout the year.

It = Total number of infants.

RESULTS

Group composition and survivorship: A total of 1509 langurs were counted in 35 different groups. Twenty three unimale bisexual groups contributed 1179 individuals (Mathur and Manohar 1994). On an average, each unimale bisexual group had 1 adult male, 23.6 adult females, 3.3 subadult females, 10.1 juveniles, 7.2 infants-II and 6.3 infant-I (Table 1). Three multimale bisexual groups added 124 members to the grand total. Their mean group size

was 41.3 with a composition of 3.6 adult males, 17 adult females, 5.6 subadult males, 2.3 subadult females, 7.3 juveniles and 5.3 infants (Table 2). Lastly, 9 allmale groups (total 206 members, mean group size 22.9) had an average group composition of 5.3 adult males, 9.6 subadult males and 7.9 juvenile males (Table 3).

Among 1509 individuals there were in all 82 adult males, 104 subadult males, 594 adult females, 83 subadult females, 327 juveniles and 319 infants. Out of 82 adult males 23 lived in unimale bisexual groups, 11 in multimale bisexual groups and 48 in all male groups. But out of the total adult and subadult males (i.e. 186) 135 lived outside bisexual groups in

TABLE 1
GROUP NUMBER AND COMPOSITION OF UNIMALE GROUPS OF THE HANUMAN
LANGUR (*Presbytis entellus*) IN JAIPUR

No.	Place	Habitat	Group	AM	AF	SAM	SAF	JUV	I ²	I ¹	Total	Sex Ratio
1.	Govindeo Temple	Temple	GUM I	1	22	0	6	7	5	1	42	1:22
2.	Galta Temple	Temple	G V	1	35	0	3	20	5	12	76	1:35
3.	Gaitore	Tourist spot	GAUM II	1	18	0	3	4	0	5	31	1:18
4.	Gaitore	Tourist spot	GAUM III	1	11	0	0	6	9	0	27	1:11
5.	Jantar Mantar	Tourist spot	JAM	1	18	0	5	5	4	3	36	1:18
6.	Amber Fort	Tourist spot	AUM I	1	34	0	5	23	16	1	80	1:34
7.	Vidhyadhar Garden	Tourist spot	VUM	1	27	0	3	11	3	10	55	1:27
8.	Brahmpuri	Residential Area	GAUM I	1	22	0	2	6	7	4	42	1:22
9.	Bani Park	Residential Area	BPUM I	1	16	0	3	8	6	2	36	1:16
10.	Tilaknagar	Residential Area	TUM I	1	21	0	2	10	1	6	41	1:21
11.	Bapu Nagar	Residential Area	BUM I	1	12	0	1	2	0	4	20	1:12
12.	Durgapura	Residential Area	DUM I	1	12	0	2	6	4	2	27	1:12
13.	Jhotwara	Residential Area	JWUM I	1	10	0	2	2	2	2	19	1:10
14.	Sanganer	Residential Area	SAUM I	1	17	0	1	6	6	7	38	1:17
15.	'C' Scheme	Residential Area	CUM	1	20	0	0	4	9	2	36	1:20
16.	Ambagarh Reserve Forest	Forest/Village	G III	1	49	0	7	34	13	14	118	1:49
17.	Ambagarh Reserve Forest	Forest/Village	G IV	1	43	0	11	14	18	15	102	1:43
18.	Jhalana	Forest/Village	JHUM	1	13	0	3	4	0	0	21	1:13
19.	Sagar I	Forest/Village	SGUM I	1	28	0	2	7	8	6	52	1:28
20.	Sagar II	Forest/Village	SGUM II	1	26	0	3	5	7	11	53	1:26
21.	Khatipura	Forest/Village	KUM I	1	24	0	1	9	11	8	54	1:24
22.	Khatipura	Forest/Village	KUM II	1	27	0	3	11	3	10	55	1:27
23.	Jagatpura	Forest/Village	JGUM	1	38	0	8	30	21	20	118	1:38
Jaipur				1	23.6	0	3.3	10.1	7.2	6.3	51.2	1:23

Total individuals: 1179
Average group size: 51.2

TABLE 2
COMPOSITION AND SEX RATIO OF MULTIMALE GROUPS OF HANUMAN LANGUR (*Presbytis entellus*)

No.	Place	Habitat	Group	AM	AF	SAM	SAF	JUV	I ²	I ¹	Total	AM/AF sex ratio
1.	Govindeo Temple	Temple	GMM II	5	16	8	4	7	5	0	45	1:3.2
2.	Amber Fort	Tourist Spot	AMM II	4	13	2	2	1	3	1	26	1:3.2
3.	Sisodia Garden	Tourist Spot	SMM I	2	22	7	1	14	7	0	53	1:11
				3.6	17	5.6	2.3	7.3	5.3		41.3	1:4.7
Total individuals:		124										
Average groupsize		41.3										

TABLE 3
COMPOSITION OF ALLMALE GROUPS OF HANUMAN LANGUR
(*Presbytis entellus*)

No.	Place	Habitat	Group	AM	SAM	JUV	Total
1.	Govindeo Temple	Temple	GAM	3	4	7	14
2.	Ghatgate	Residential area	GGAM	5	4	9	18
3.	Tilak Nagar	" "	TAM	8	3	11	22
4.	Bani Park	" "	BPAM II	8	10	5	23
5.	Jhotwara	" "	JWAM I	4	15	3	22
6.	Nahargarh Reserve Forest	Forest/Village	NHAM	5	28	9	42
7.	Durgapura	Residential area	DAM II	4	0	0	4
8.	Ambagarh Reserve Forest	Forest/Village	AM I	8	23	27	58
9.	Ambagarh Reserve Forest	" "	AM II	3	0	0	3
Mean				5.3	9.7	7.9	22.9

Total Individuals: 206
Average groupsize: 22.9

TABLE 4
GROUP COMPOSITION AND SEX RATIO OF HANUMAN LANGUR GROUPS

No.	Type of group	AM	AF	SAM	SAF	J	I	Total	Sex Ratio AM : AF		
1.	Unimale (n = 23)	23	543	-	76	234	303	1179	1 : 23		
2.	Multimale (n = 3)	11	51	17	7	22	16	124	1 : 4.6		
Total		34	594	17	83	256	319	1303			
3.	Allmale (n = 9)	48	-	87	-	71	-	206			
Grand Total		82	594	104	83	327	319	1509			
Overall		SAM + AM : SAF + AF									

1 : 3.6

TABLE 5
SOCIONOMIC AGE SEX RATIO IN BISEXUAL GROUPS

No.	Age and Sex			Ratio		
1.	AM	:	AF	1	:	17.4
2.	AM + AF	:	SA+J+I	1	:	1.07
3.	AF	:	SA+J+I	1	:	1.13
4.	AF	:	J+I	1	:	0.96
5.	AF	:	I	1	:	0.53
6.	AF	:	SA	1	:	0.16
7.	AF	:	J	1	:	0.43

TABLE 6
GROUP COMPOSITION OF BISEXUAL GROUPS IN DIFFERENT HABITATS

No.	Habitat	Total number of individuals						Ratio	
		A/M	A/F	SA/M	SA/F	J	I	AF:J	AF:I
1.	Temple	7	73	8	13	34	28	1:0.4	1:0.2
2.	Tourist	11	143	9	19	64	62	1:0.4	1:0.1
3.	Residential	8	130	-	13	44	64	1:0.3	1:0.1
4.	Forest village	8	248	-	38	114	165	1:0.4	1:0.1

TABLE 7
BIRTH RATE IN UNIMALE BISEXUAL GROUPS IN FOUR DIFFERENT HABITAT

No.	Place and habitat	Type of group and number	Total No. of adult female	Infants born in whole year	Birth rate
1.	Govindeo (Temple area)	Unimale GUM I	26	8	0.3
2.	Brahmpuri (Residential area)	Unimale GAUM I	22	4	0.18
3.	Jagatpura (Forest/Village area)	Unimale JAUM	40	6	0.15
4.	Jantar Mantar (Tourist area)	Unimale JUM	18	6	0.3 = \bar{X} 0.23

TABLE 8
PER CAPITA RATE INCREASE IN THE POPULATION OF HANUMAN LANGURS (1986 - 87)

No.	Year	Group	Place	Habitat	AM	AF	SAM	SAF	JUV	I2	I1	Total Population	Growth rate
1.	1986	GUM I	Govindeo	Temple	1	22	0	6	7	5	1	42	
	1987		Temple		1	24	0	2	7	7	8	49	1.16
2.	1986	GAM III	Govindeo	Temple	3	0	4	0	8	0	0	15	
	1987		Temple		5	0	4	0	2	0	0	11	0.73
3.	1986	G V	Galta	Temple	1	35	0	3	20	5	12	76	
	1987				1	32	0	2	21	10	10	80	1.05
4.	1986	JUM	Jantar	Tourist	1	18	0	3	4	5	5	36	
	1987		Mantar	spot	1	18	0	3	7	7	6	42	1.16
5.	1986	AUM I	Amber	Tourist	1	34	0	5	23	16	1	80	
	1987		Fort	Spot	1	34	0	6	26	12	10	88	1.10
6.	1986	VUM	Vidhyadhar	Tourist	1	27	0	3	11	3	10	55	
	1987		Garden	spot	1	26	0	1	10	4	13	55	1.00
7.	1986	SMM I	Sisodia	Tourist	2	22	7	1	14	7	0	53	
	1987		Garden	spot	1	22	0	1	5	0	7	36	0.67
8.	1986	BUM	Bapu Nagar	Residential area	1	12	0	1	2	2	2	20	
	1987				1	12	0	1	2	4	3	23	1.15
9.	1986	GAUM	Brahmpuri	Residential area	1	22	0	2	6	7	4	42	
	1987				1	20	0	2	8	7	6	44	1.04
10.	1986	TAM II	Tilak Nagar	Residential area	8	0	3	0	11	0	0	22	
	1987				12	0	3	0	14	0	0	29	1.31
11.	1986	DUM I	Durgapura	Residential area	1	12	0	2	6	4	2	27	
	1987				1	12	0	2	6	3	2	26	0.96
12.	1986	JWUM I	Jhotwara	Residential area	1	10	0	2	2	2	2	19	
	1987				1	10	0	3	1	3	2	20	1.05
13.	1986	SAUM	Sanganer	Residential area	1	17	0	1	6	6	7	38	
	1987				1	16	0	1	6	5	9	38	1.00
14.	1986	GGAM	Ghatgate	Residential area	5	0	4	0	9	0	0	18	
	1987				4	0	2	0	9	0	0	15	0.83
15.	1986	BPUM	Bani Park	Residential area	1	16	0	3	8	6	2	36	
	1987				1	14	0	3	4	4	0	26	0.72
16.	1986	'C' UM	'C' Scheme	Residential area	1	20	0	0	4	9	2	36	
	1987				1	24	0	0	2	4	1	32	0.88
17.	1986	JHUM	Jhalana	Forest/	1	13	0	3	4	0	0	21	
	1987			Village	1	11	0	3	4	0	3	22	1.04
18.	1986	SGUM I	Sagar	Forest/	1	28	0	2	7	8	6	52	
	1987			Village	1	28	0	2	5	9	8	53	1.01
19.	1986	JGUM	Jagatpura	Forest/	1	38	0	8	30	21	20	118	
	1987			Village	1	38	0	9	32	22	23	125	1.06
20.	1986	KUM I	Khatipura	Forest/	1	27	0	3	11	3	10	55	
	1987			Village	1	27	0	3	14	6	12	63	1.14

$= \bar{X} 1.003$

allmale groups (Table 4). Sex-ratio between adult males and adult females of unimale bisexual groups was 1:23. If all the females (adults and subadults) and all the males (adults and subadults) of all three types of groups were added then the sex-ratio was 1:3.6 (Table 4). The socio-economic sex and age ratio in bisexual groups (unimale and multimale) between AF:I was 1:0.53, whereas, the ratio between AF:SA and AF: J was 1:0.16 and 1:0.43 (Table 5). Maximum number of infants were observed in forest/village habitat followed by residential, tourist and least in temple areas (Table 6). Percentage of different age-sex classes were calculated for survivorship. Percentage of adult males was more in the residential area as compared to other habitats. Adult female survivorship was highest in the forest/village (46.5%). Percentage of subadult males was more in residential area whereas, subadult females and juveniles percentage was highest in temple areas (73% subadult females, 23.1% juvenile). The highest percentage in the langur groups was that of adult females followed by juveniles, infants-I, subadult males, adult males and lastly subadult females.

Monthly census of unimale bisexual groups in different habitats for birth rate: Between 1986 to March 1987 eight infants were born in GUM, four in GAUM, six each in JUM and JAUM and the birth rate was calculated as 0.3, 0.18, 0.3 and 0.15 respectively. The average birth rate for Jaipur langurs in one year was 0.23 (Table 7).

Population growth: The per capita rate of increase in group size, i.e. population growth λ was estimated in twenty langur groups in different habitats. Three groups in temple area (GUM, GAM III and G V), four groups from tourist area (JUM, AUM I, VUM and SMM I) nine groups in residential area (BUM, GAUM, TAM II, DUM I, JWUM I, SAUM, GGAM, BPUM and 'C'UM) and four groups from forest/village, namely JHUM, SGUM I, JGUM and KUM I were censused in 1986 and then in 1987 for population growth. The mean value of lambda in temple, tourist, residential and forest/village was 0.98, 9.8, 0.99 and 1.06 respectively. The mean value of lambda was 1.003 (Table 8).

DISCUSSION

In the present investigation, birth rate, survival of infant and AF:J ratio were highest in temple and tourist areas perhaps due to high rate of provisioning, and complete protection from religious beliefs. Similar type of results for rhesus were reported by Southwick and Siddiqi (1977).

A comparison of mean group composition of bisexual groups of Jaipur with other research sites indicated much higher number of females (17.4) to each adult male. The sex ratio for *Presbytis entellus* is reported to vary with habitat (Poirier 1988). Laws and Laws (1984) reported 1:4 male to female ratio in four bisexual groups. Jay (1965) had noted 1:1.5 to 2 for Kaukori and Orcha langurs. Hrdy (1977) noted 1:8 for Mount Abu. Roonwal and Mohnot (1977) noted that the range of socio-economic sex ratio for *Presbytis entellus* varies from 1:1.5 to 1:9 with the average in the range of 1:1.5 to 2. In the present investigation the sex ratio between SAM + AM (subadult male + adult male) : SAF + AF (Subadult female + adult female) was 1:3.6 (Table 4). The socio-economic sex and age ratio of langurs of bisexual groups of Jaipur showed a gradual decline in AF:I, AF:J and AF:SA ratio indicating a poor recruitment of breeding individuals in their population. The ratio of AF:I reflects potential recruitment to the population if mortality factors do not operate. AF:SA's ratio on the other hand, shows the actual rate of addition to the breeding population after considering mortality factors that have operated. A comparison of data with other research sites suggested that the population of langurs in Jaipur are breeding better than langur population at Bhimthal, Bundala, Dharwar, Kanha, Polonnaruwa, Raipur, Ranthambhore, Wilpattu (Refer Table in Moore 1985).

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